Winter is coming:
An environmental monitoring and spatiotemporal modelling approach for better understanding of respiratory disease (COPD)

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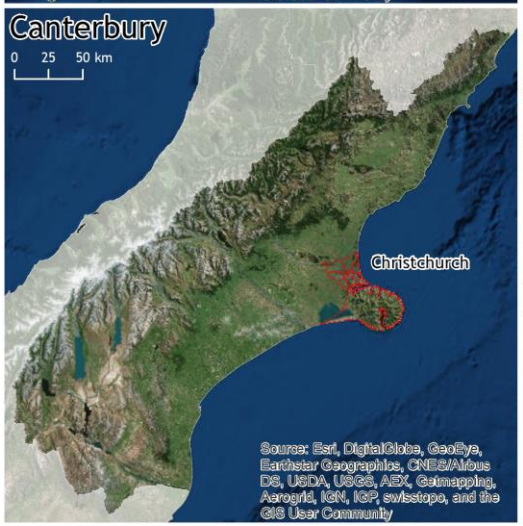
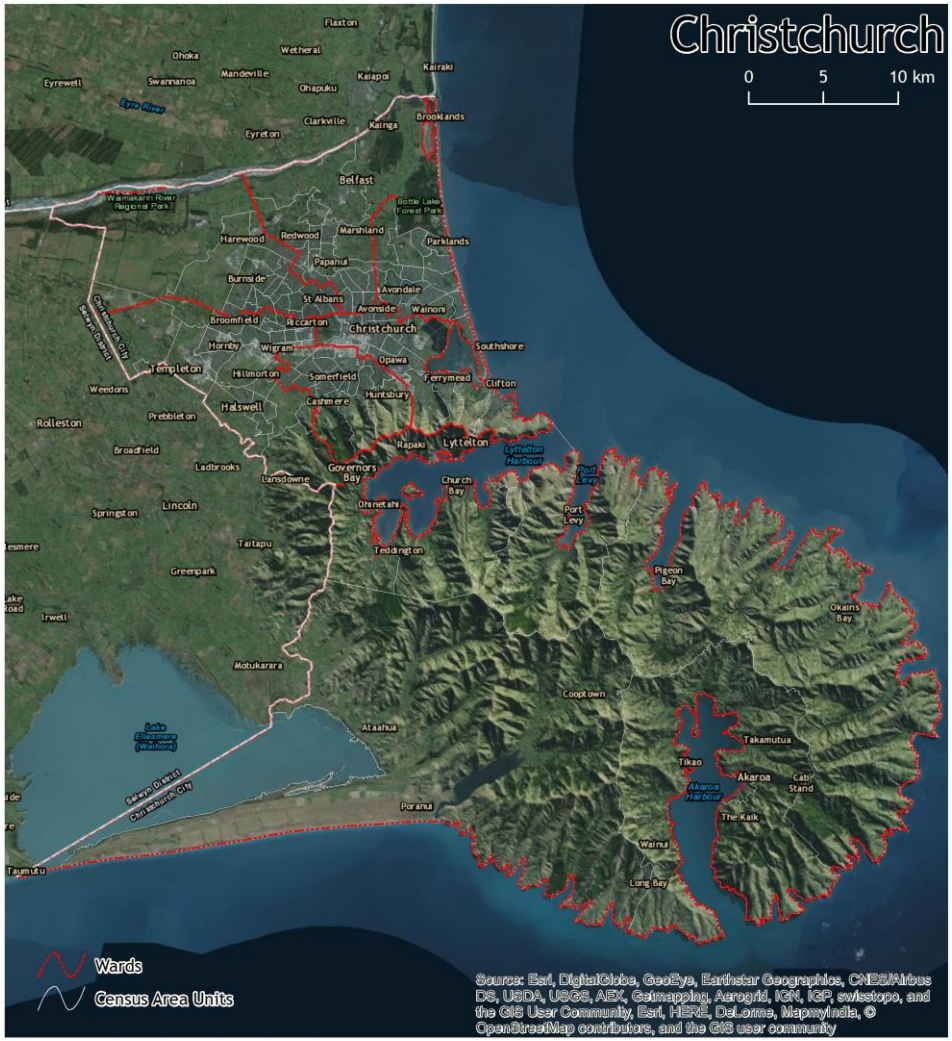
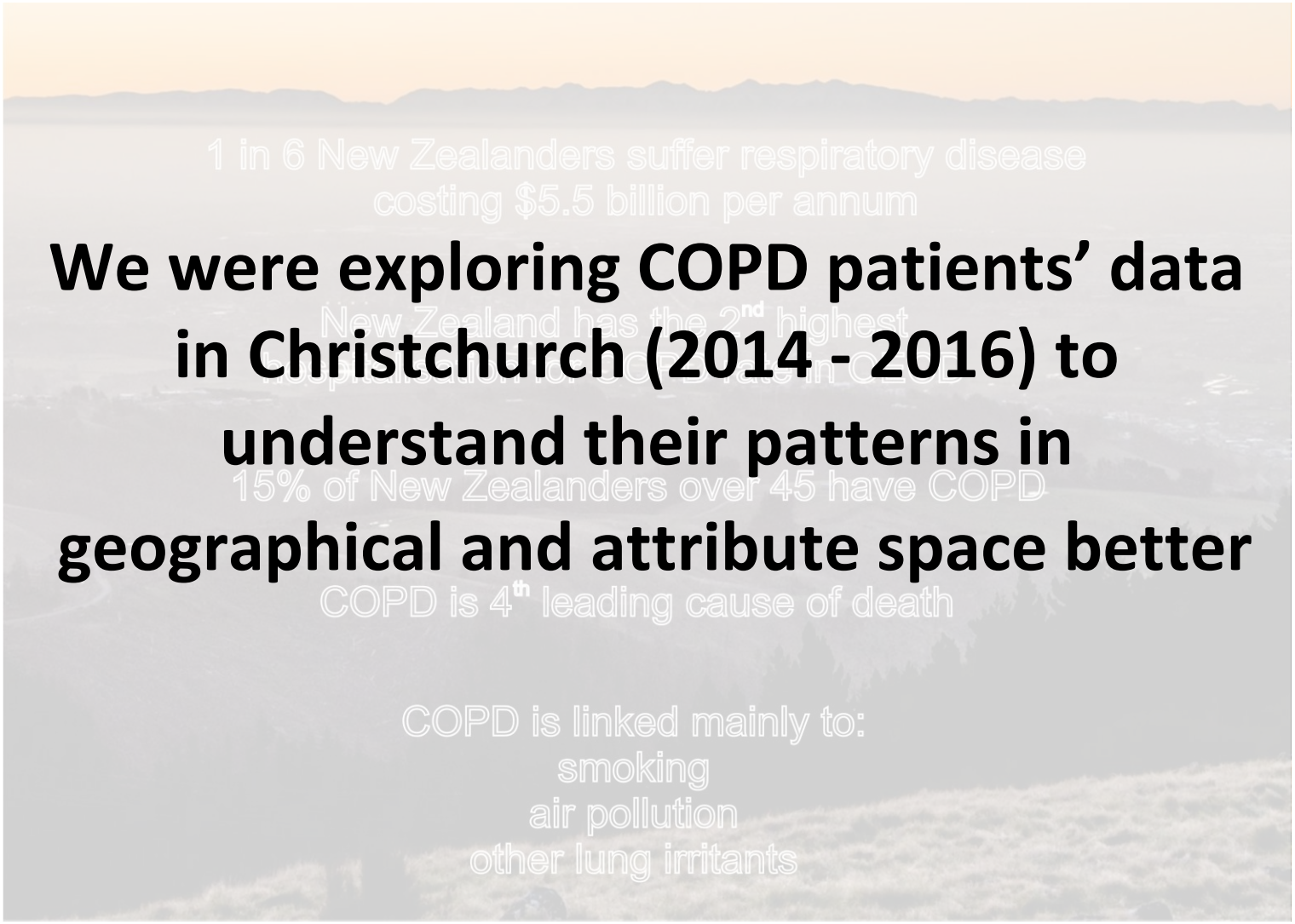
Christchurch



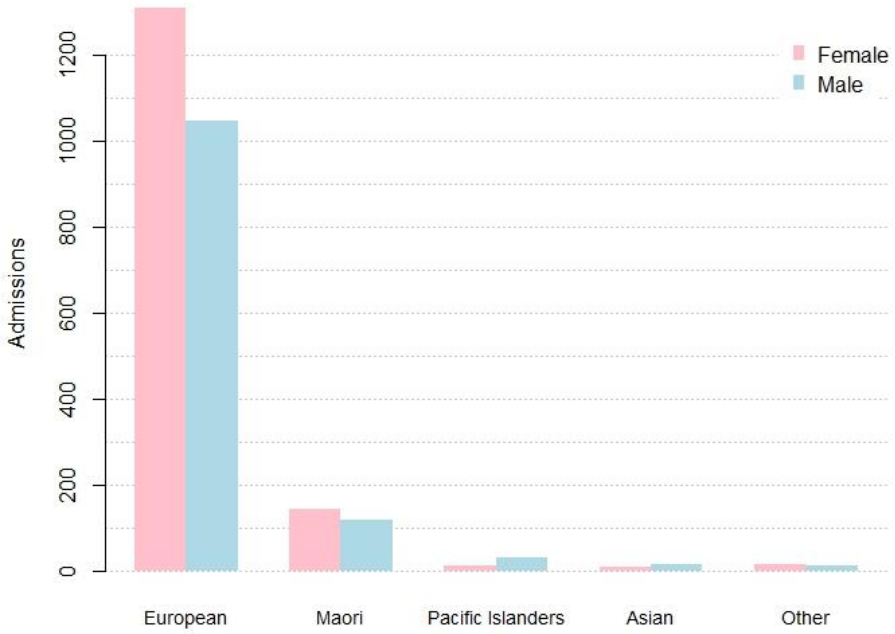


The City and its Health

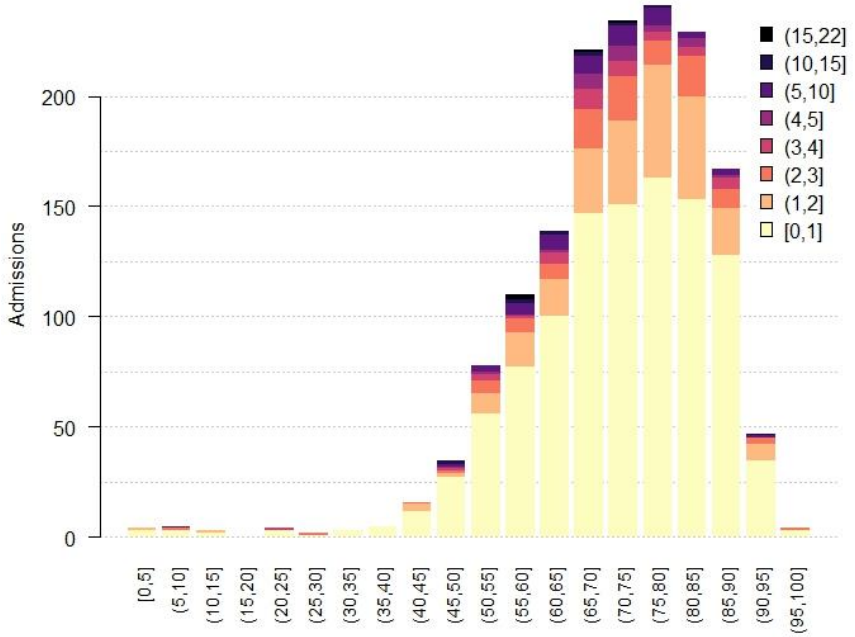


We were exploring COPD patients' data in Christchurch (2014 - 2016) to understand their patterns in geographical and attribute space better

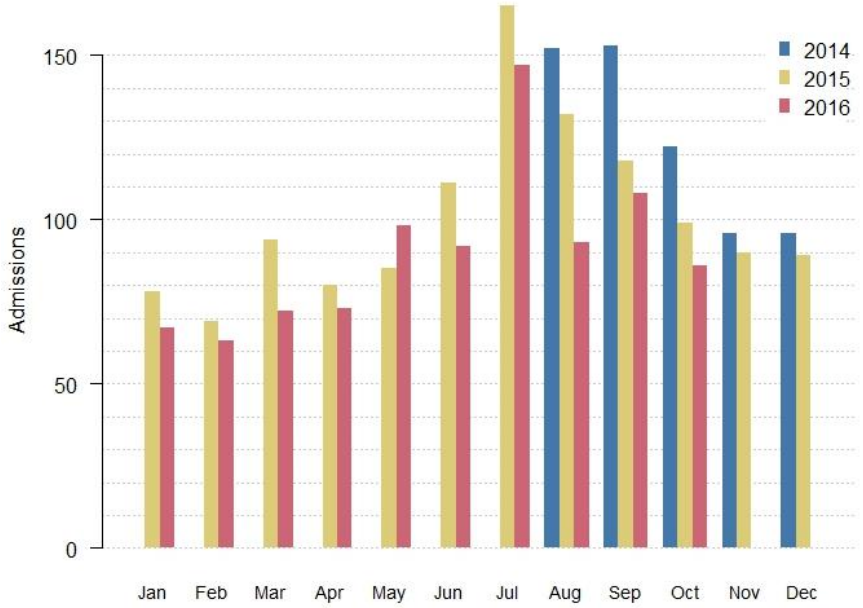
Ethnicity and gender



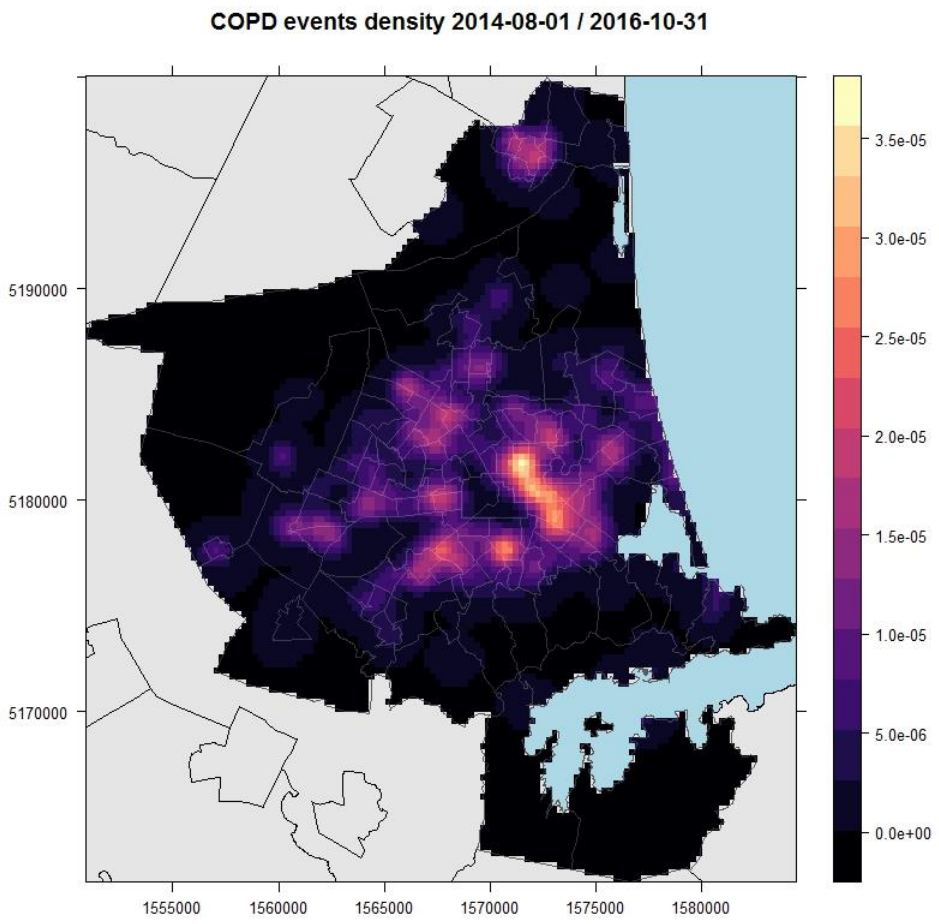
Age and multiple hospitalisations

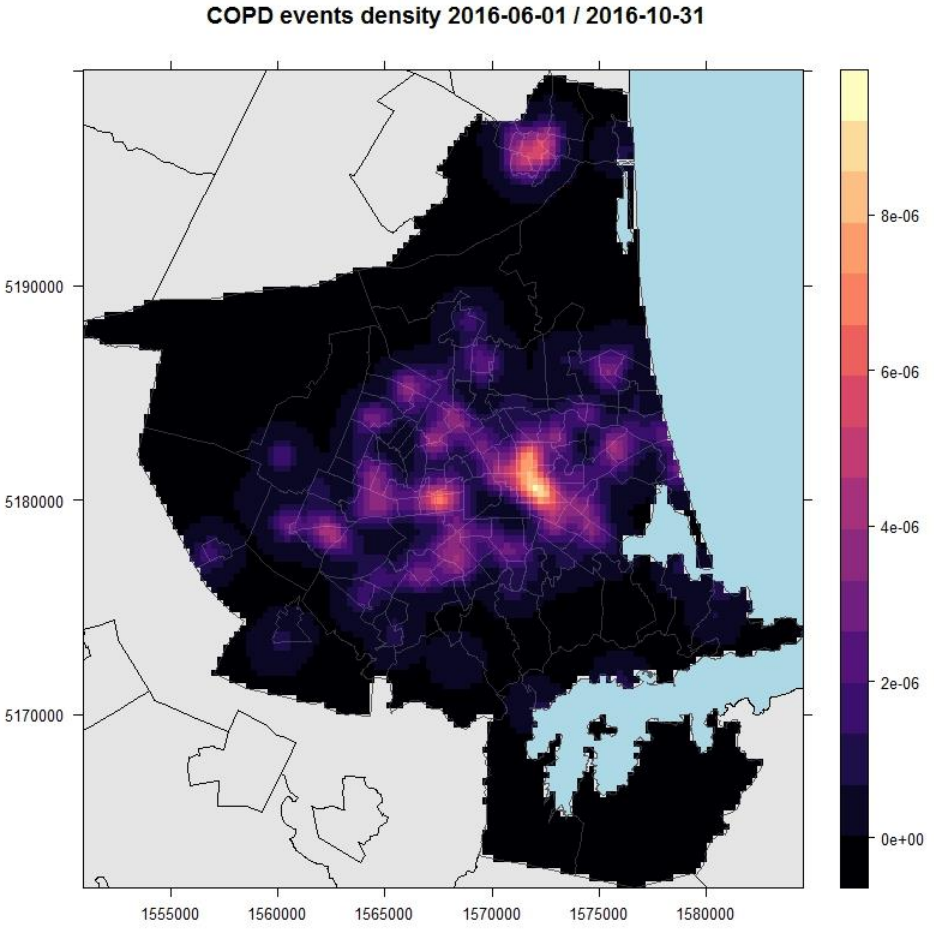


Month of hospitalisations

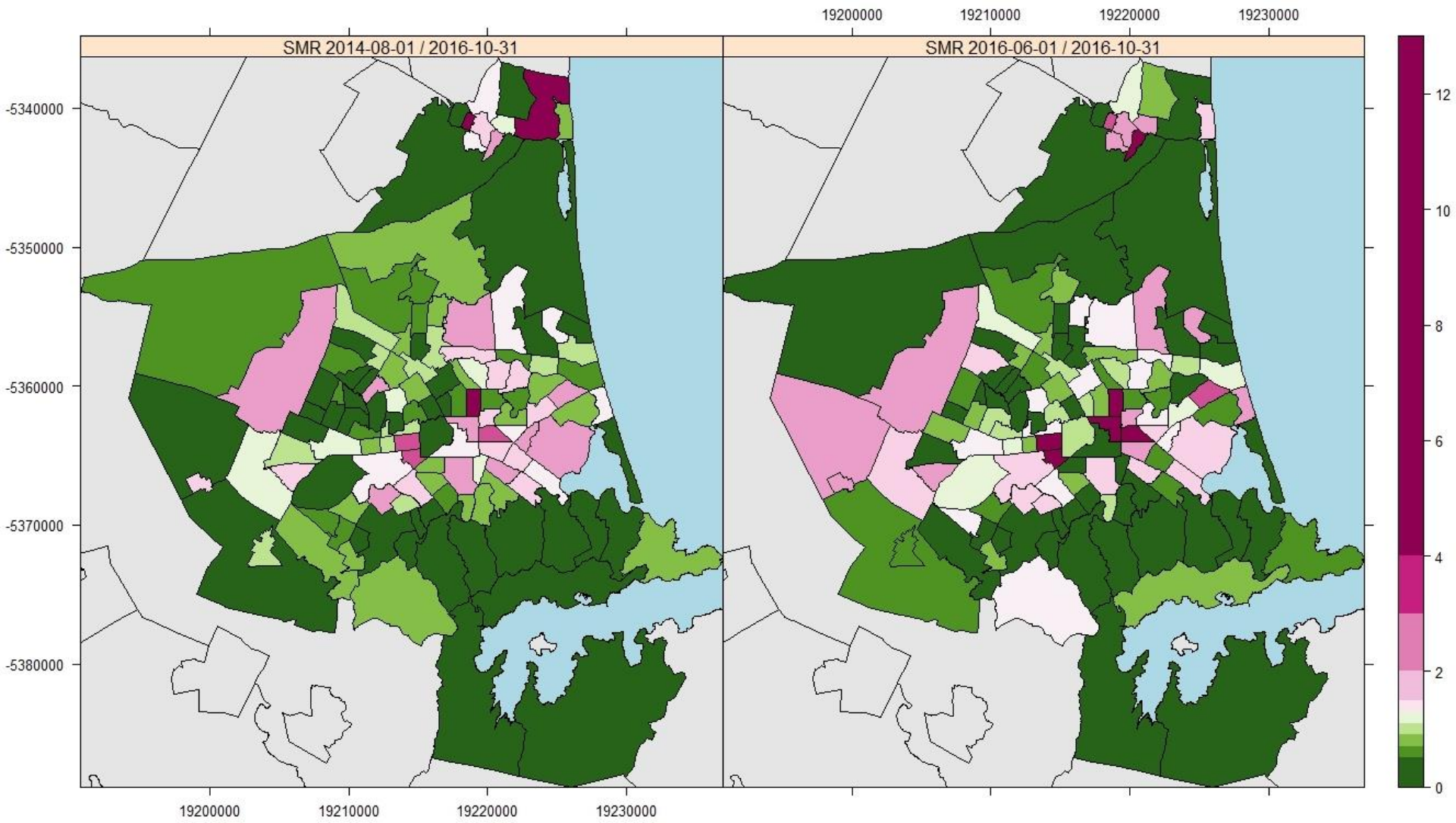


COPD Events density

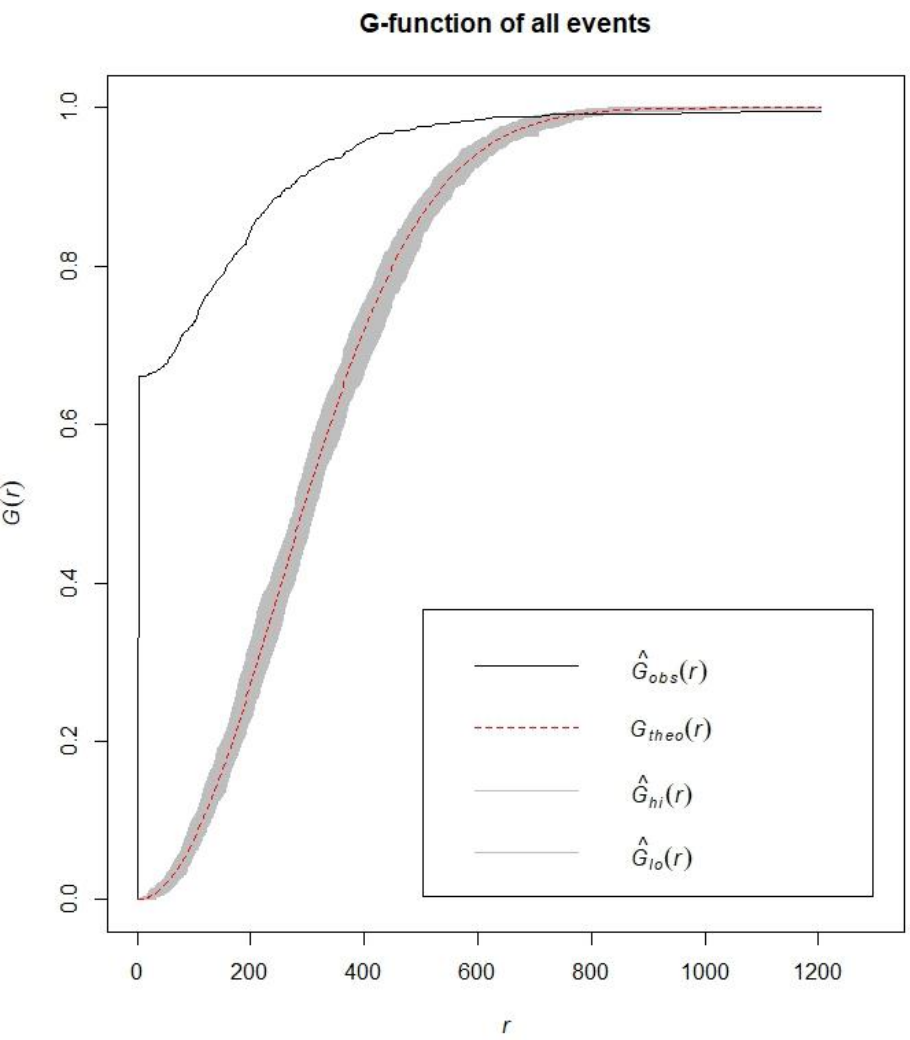


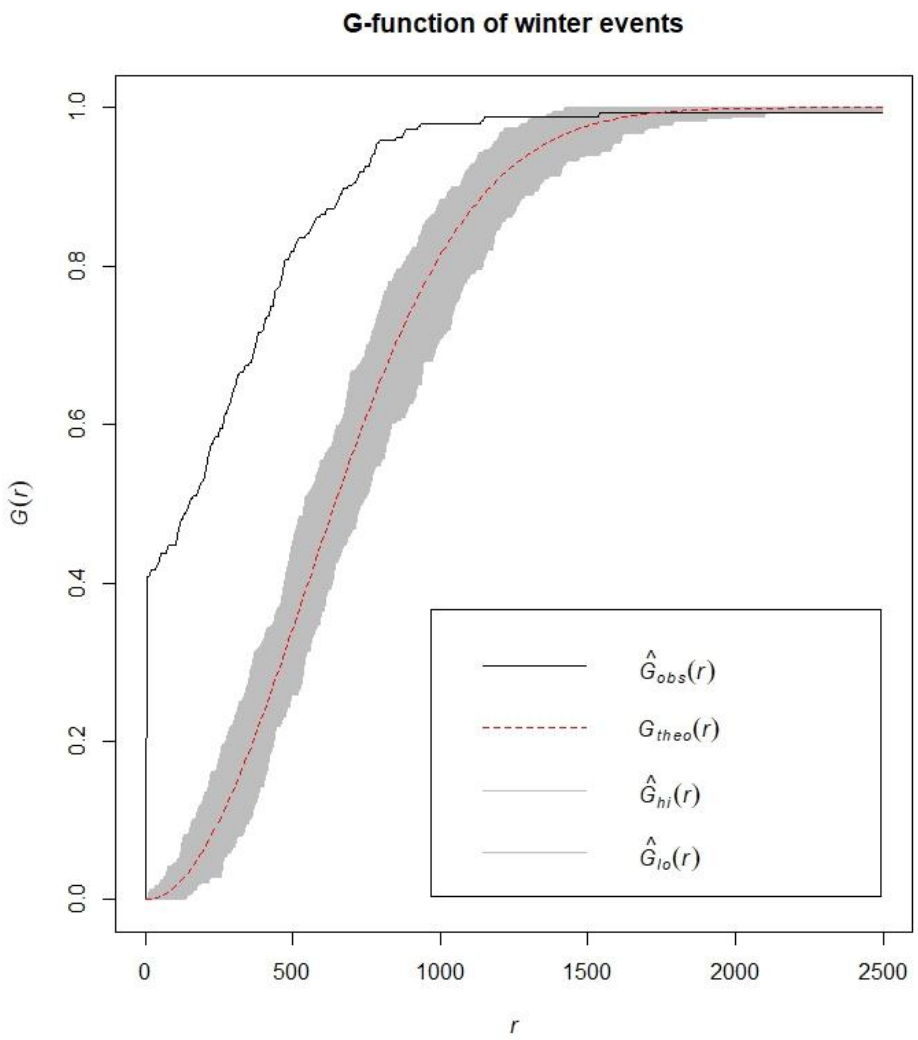


COPD Events distribution



Spatial pattern





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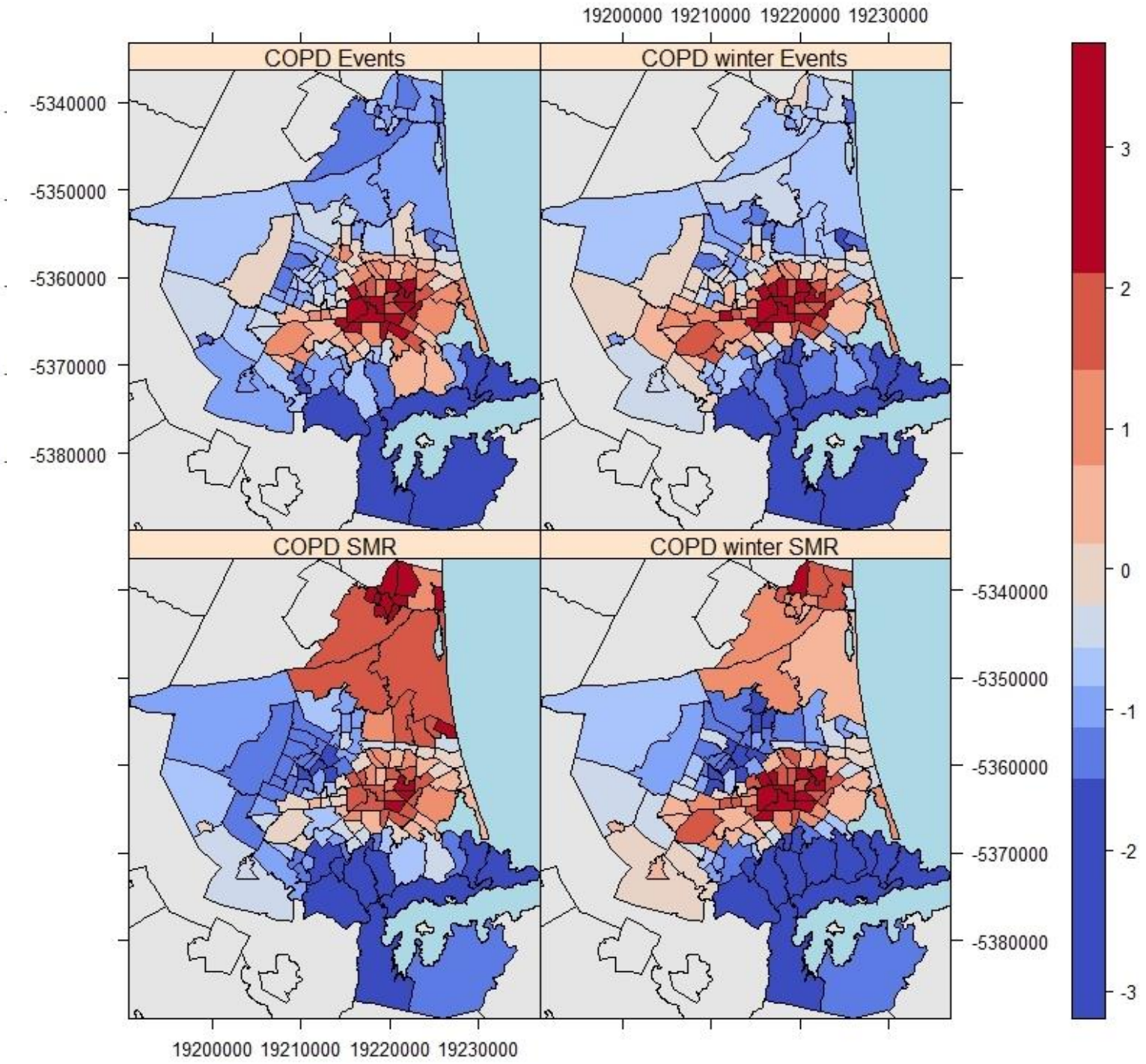
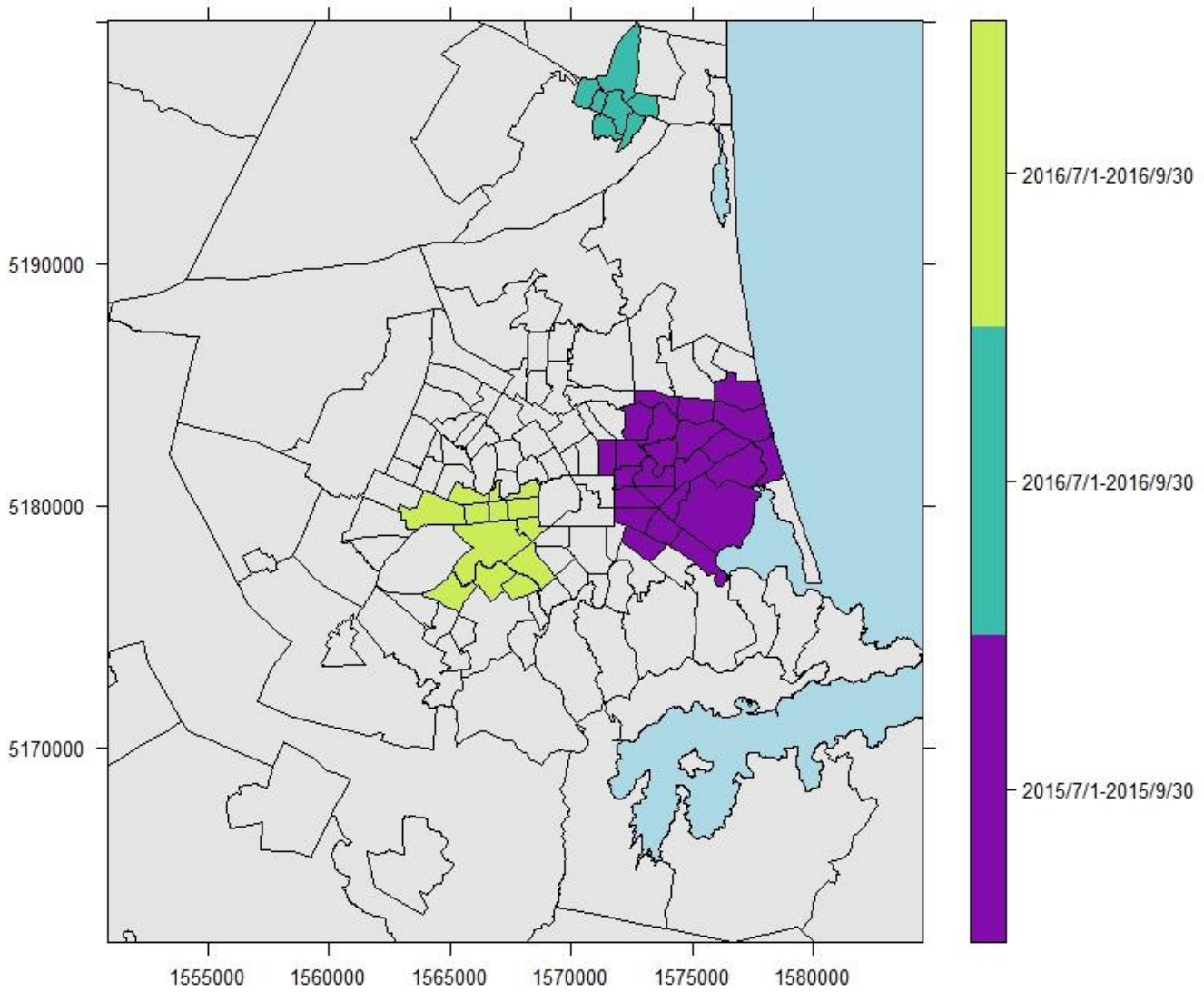
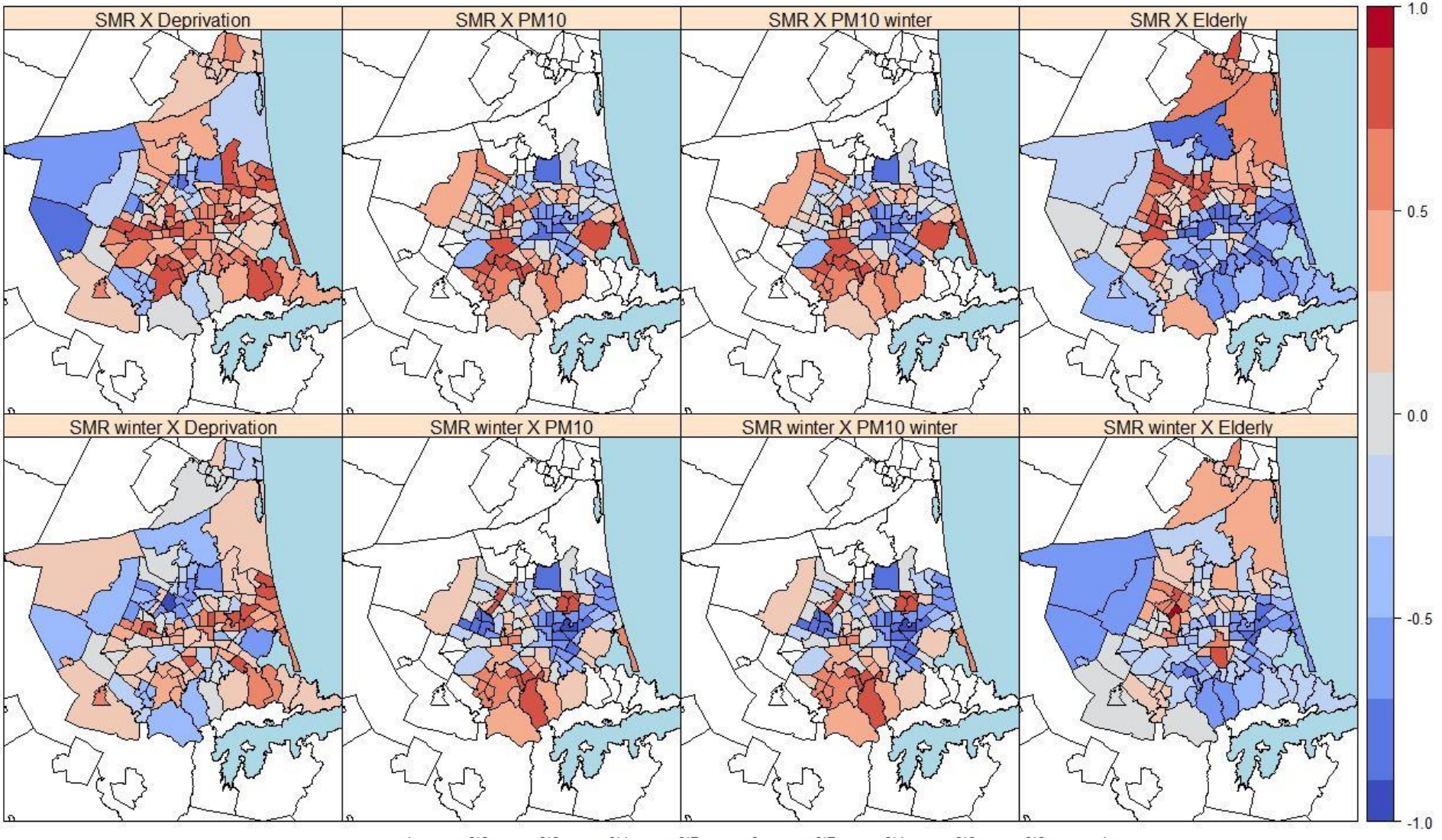


Spatial and temporal pattern



Cofactors and correlations



Clustering of individuals

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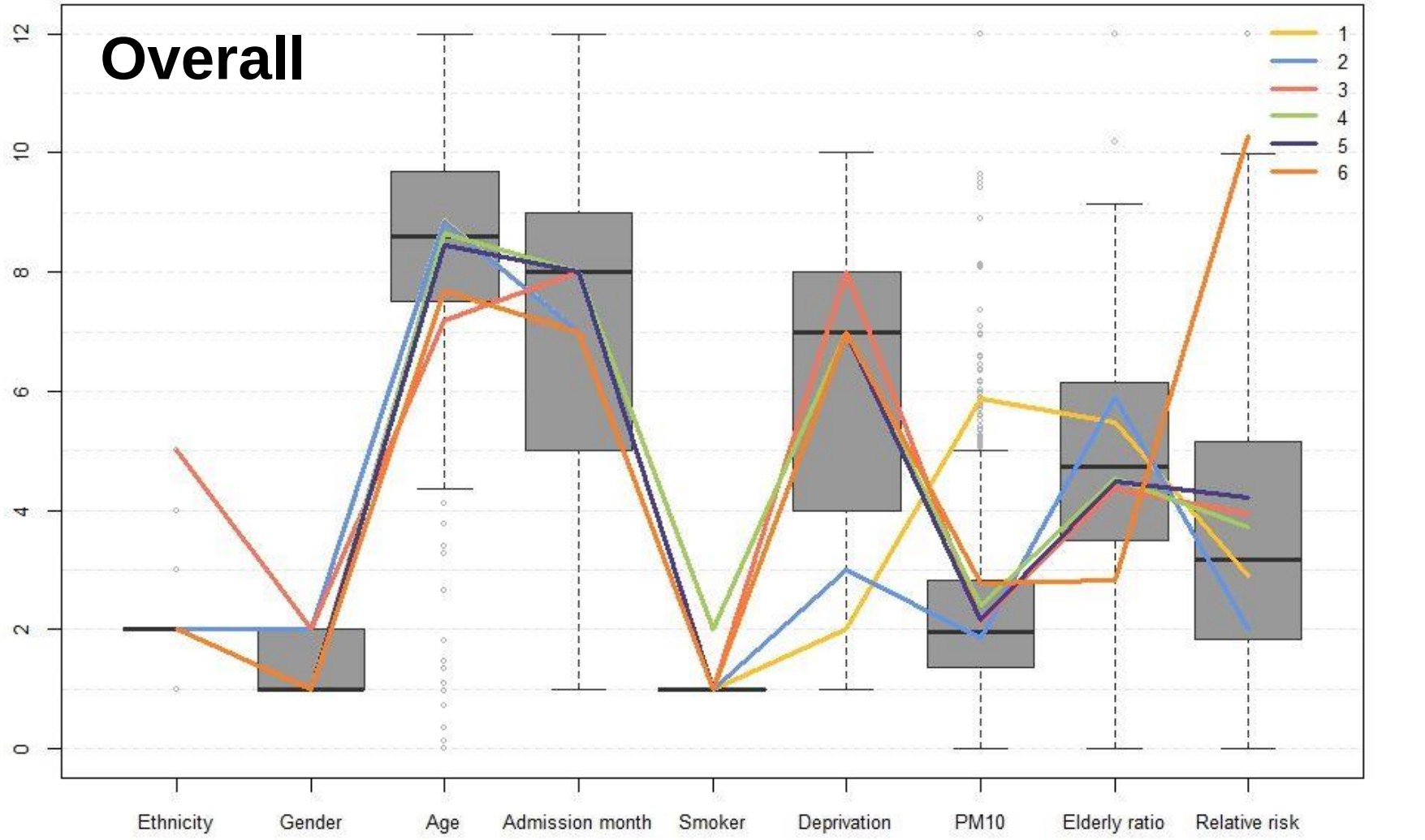
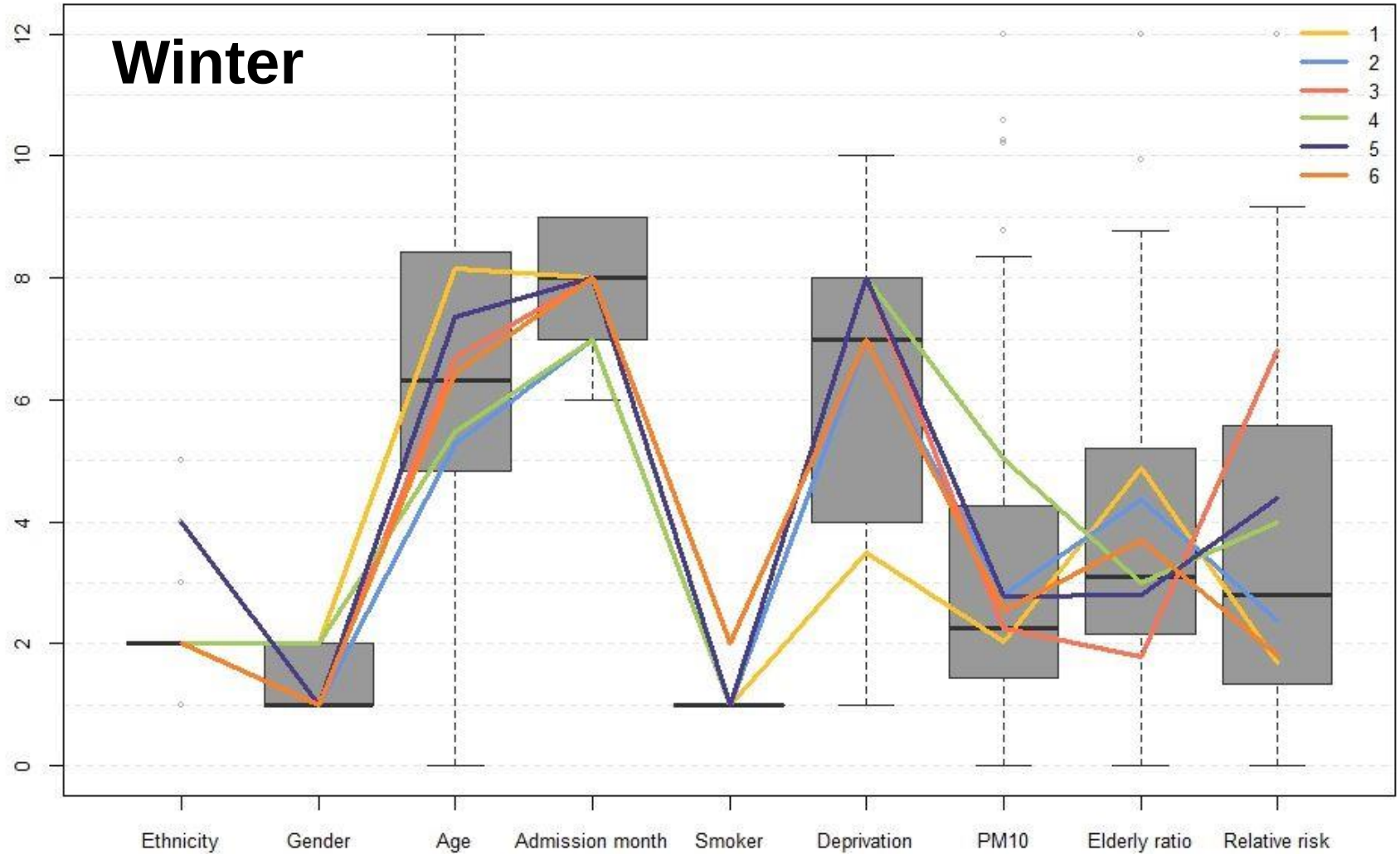
	Group1 (n = 49)			Group 2 (n = 470)			Group 3 (n = 36)			Group 4 (n = 39)			Group 5 (n = 834)			Group 6 (n = 100)			
	mean	sd	median	mean	sd	median	mean	sd	median	mean	sd	median	mean	sd	median	mean	sd	median	
Ethnicity	2,14	0,50	2,00	1,96	0,20	2,00	4,94	0,23	**5,00**	2,08	0,35	2,00	2,20	0,45	2,00	2,14	0,35	2,00	Overall
Gender	1,57	0,50	**2,00**	1,51	0,50	**2,00**	1,69	0,47	**2,00**	1,26	0,44	**1,00**	1,40	0,49	**1,00**	1,16	0,37	**1,00**	
Age	**73,27**	11,24	76,00	72,93	11,93	74,00	**59,22**	24,09	69,00	71,26	15,31	76,00	69,59	12,67	70,00	63,38	8,76	61,00	
Month of admission	7,04	1,14	7,00	6,83	3,23	7,00	7,36	2,99	8,00	7,41	2,84	8,00	**7,52**	2,88	8,00	**6,34**	3,04	7,00	
Smoker	1,00	0,00	1,00	1,00	0,00	1,00	1,00	0,00	1,00	2,00	0,00	**2,00**	1,00	0,00	1,00	1,00	0,00	1,00	
Deprivation	**3,18**	2,53	2,00	3,27	1,93	3,00	7,50	2,36	8,00	6,05	2,72	7,00	7,07	1,64	7,00	**7,77**	1,00	7,00	
Daily PM10	**49,04**	16,22	44,69	**17,34**	6,81	16,67	19,42	7,13	18,53	21,62	9,67	19,79	19,68	8,38	18,15	24,58	11,91	21,22	
Elderly ratio	16,37	4,42	14,99	**17,39**	3,92	17,62	13,66	3,66	13,12	14,04	4,45	12,73	13,96	3,74	12,65	**9,90**	2,81	7,97	
SMR	1,27	0,98	0,89	**0,90**	0,49	0,86	1,69	0,76	1,59	1,61	1,19	1,35	1,81	0,87	1,78	**4,30**	0,81	4,59	

	Group1 (n = 58)			Group 2 (n = 59)			Group 3 (n = 63)			Group 4 (n = 57)			Group 5 (n = 9)			Group 6 (n = 7)			
	mean	sd	median	mean	sd	median	mean	sd	median	mean	sd	median	mean	sd	median	mean	sd	median	
Ethnicity	2,03	0,18	2,00	2,08	0,41	2,00	2,19	0,47	2,00	2,23	0,42	2,00	4,44	0,53	**4,00**	2,00	0,00	2,00	Winter
Gender	1,71	0,46	**2,00**	1,00	0,00	**1,00**	1,31	0,46	**1,00**	1,74	0,44	**2,00**	1,33	0,50	**1,00**	1,14	0,38	**1,00**	
Age	**79,71**	9,21	78,00	**66,10**	11,35	67,00	72,80	11,23	71,00	67,05	10,02	68,00	75,89	10,54	79,00	71,57	13,65	80,00	
Month of admission	8,00	0,99	8,00	7,48	1,09	7,00	**8,05**	0,97	8,00	**6,79**	0,62	7,00	7,89	0,93	8,00	7,86	1,21	8,00	
Smoker	1,00	0,00	**1,00**	1,00	0,00	**1,00**	1,00	0,00	**1,00**	1,00	0,00	**1,00**	1,00	0,00	**1,00**	2,00	0,00	**2,00**	
Deprivation	**3,84**	2,40	3,50	5,83	2,17	7,00	**7,85**	1,26	8,00	6,82	2,08	8,00	6,56	3,05	8,00	6,29	2,50	7,00	
Daily PM10	**10,46**	6,19	9,57	13,75	6,25	12,53	11,44	7,53	9,42	**23,35**	10,50	21,74	13,66	7,40	10,88	12,70	11,54	7,86	
Elderly ratio	**16,99**	3,86	16,26	15,87	3,19	16,44	**10,31**	1,92	10,75	12,90	3,32	12,23	12,48	2,92	11,12	14,42	3,32	12,99	
SMR	**0,93**	0,39	0,85	1,21	0,59	1,16	**2,96**	1,27	2,74	1,84	0,95	1,79	2,01	1,44	2,59	0,99	0,60	0,84	

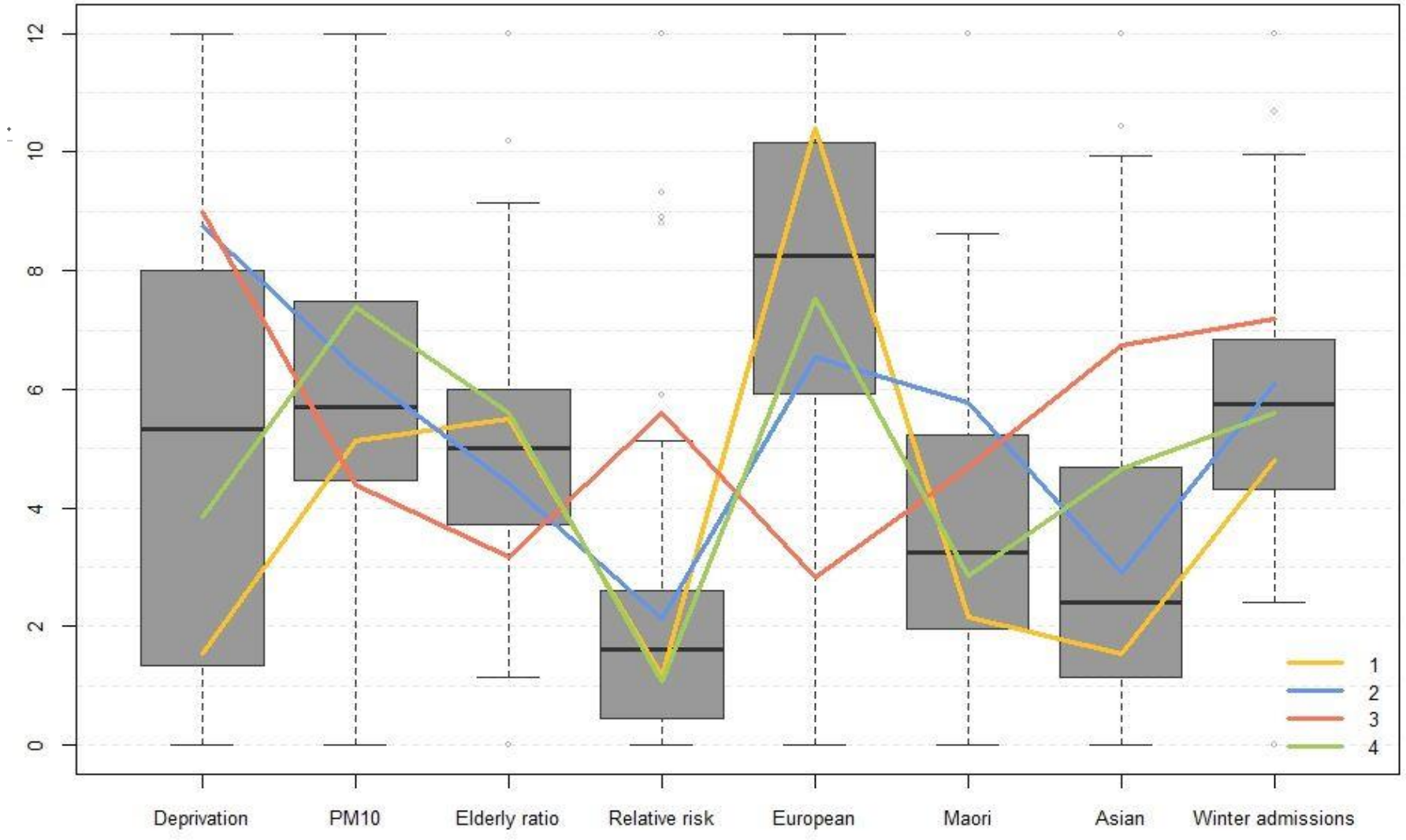
Clustering of individuals



Clustering of individuals



Clustering of areas



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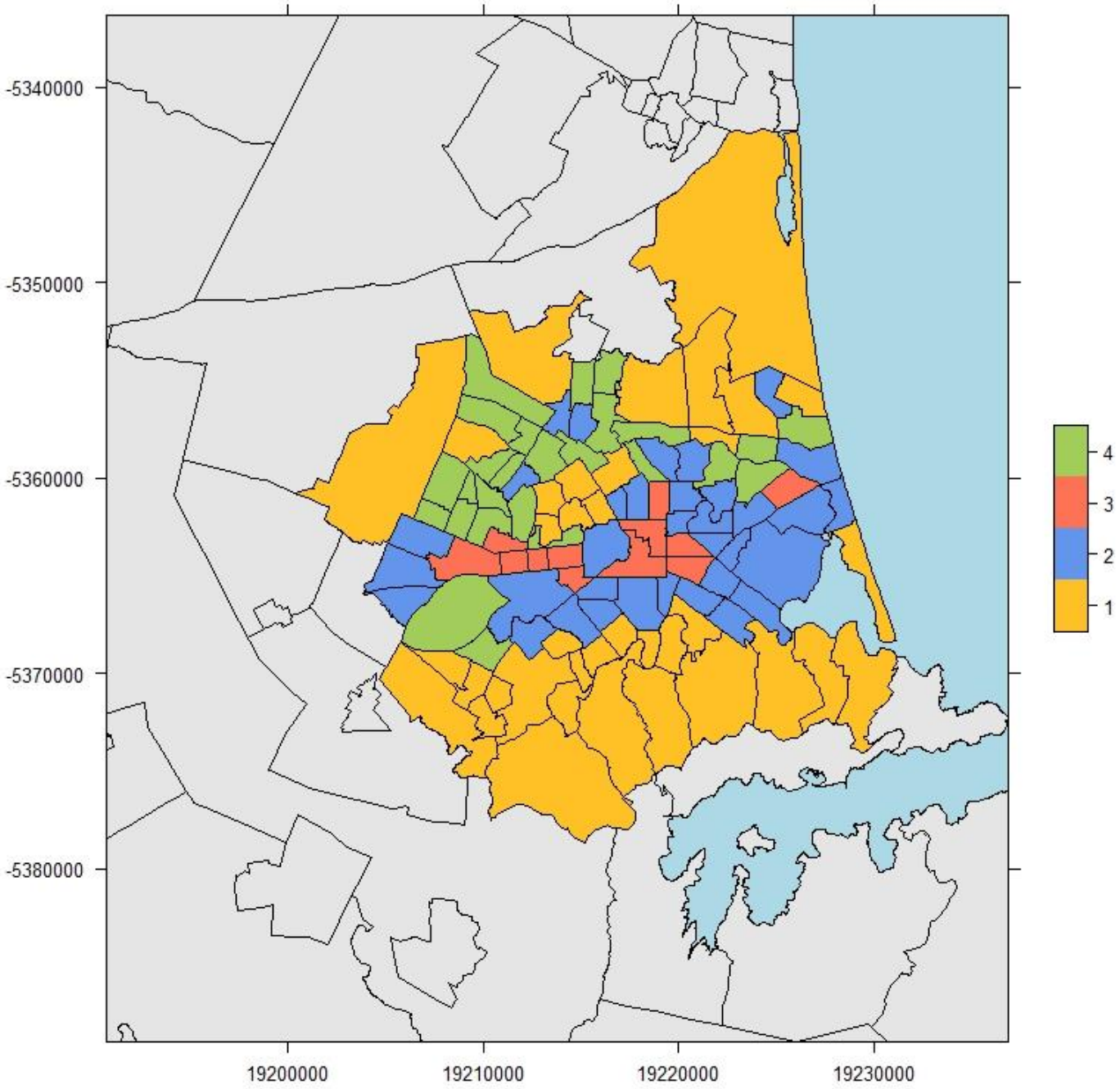
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1

Conclusions

- Using individual and aggregated locations to determine high-risk health hot spots and groups of CAUs and patients
- Winter has been confirmed as critical season but not because of PM_{10}
- Correlations between the SMR and several characteristics were identified
  - Mostly deprivation, and ratio of elderly people
- Their combination used in clustering revealed patterns within the city and among individuals as well

Discussion

- Confidentiality of individual data
- Level of admitted smokers
- PM_{10} sensors in this study
- Subjectivity in clustering processes and patterns recognition, and their description
- Spatial weighting

Participants

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future position | 60°40'17" North 17°06'29" East 213.141.90.204

Canterbury District Health Board
Te Poari Hauora ō Waitaha

Land Information New Zealand
Toitū te whenua

Government of Western Australia
Department of Health

crc·si Spatially Enabling Australia and New Zealand

Australian Government
Department of Industry

Business Cooperative Research Centres Program

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